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REMARKS/ARGUMENTS

In the Office action dated March 21, 2007, claims 1 – 22 were rejected. In response, Applicant has amended claims 1, 6, 9, 13, 17, 19, and 21, canceled claims 4 and 11, and added claims 23 and 24. Applicant hereby requests reconsideration of the application in view of the amended claims, the new claims, and the remarks made herein.

Claim Rejections Under 35 U.S.C. 101

The Office Action rejects claims 1 – 22 under 35 U.S.C. § 101 as allegedly being directed to nonstatutory subject matter.

Claims 1 and 9

Claims 1 and 9 have been amended to incorporate the limitations of claim 4, which recites "providing a notification that the random number generator is not properly providing random numbers when the output of the exponential averaging operation falls outside the predetermined acceptance range." Applicant asserts that providing a notification as recited in claims 1 and 9 is a tangible result which places the claim within the enumerated statutory categories identified in 35 U.S.C. § 101. Claim 4, as previously presented, was rejected under the logic:

> However, they do not provide any solution to what happens when the random generator properly provides random numbers. As the notification or alarm signal only occurs when the condition is met and no result is provided for when the condition is not met. Each final result of the claim must have a result for all the conditions to be statutory." (Office action, page 4, item 4)

Applicant respectfully requests that the Examiner cite a relevant statute, case, rule, or section in the MPEP to support the above-identified requirement that "each final result of the claim must have a result for all the conditions to be statutory." In the absence of some basis for this requirement, Applicant asserts that claims 1 and 9 recite a useful, concrete, and tangible result and thus fall within the enumerated statutory categories identified in 35 U.S.C. § 101.

Claim 16 includes a similar limitation to claims 1 and 9. Although the language of claim 16 differs from the language of claims 1 and 9 and the scope of claim 16 should be interpreted independently of claims 1 and 9, Applicant respectfully asserts that the remarks provided above in regard to claims 1 and 9 also apply to claim 16.

Claim 15

Claim 15 recites an "apparatus" that includes a "random number generator unit," a "detector unit," and a "switching unit." With reference to Fig. 1 of Applicant's specification, the random number generator unit is disclosed as element 12, the detector unit is disclosed as element 15, and the switching unit is disclosed as element 16, see also paragraph [0015]. MPEP 2106 specifically provides guidance for determining whether the claimed invention complies with 35 U.S.C. § 101:

> "Section 101 of title 35, United States Code, provides:
> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.
> As the Supreme Court has held, Congress chose the expansive language of 35 U.S.C. 101 so as to include "***anything under the sun that is made by man***." *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09, 206 USPQ 193, 197 (1980).
> In *Chakrabarty*, 447 U.S. at 308-309, 206 USPQ at 197, the court stated:
> In choosing such expansive terms as "manufacture" and "composition of matter," modified by the comprehensive "any," Congress plainly contemplated that the patent laws would be given wide scope. The relevant legislative history also supports a broad construction. The Patent Act of 1793, authored by Thomas Jefferson, defined statutory subject matter as "any new and useful art, machine, manufacture, or composition of matter, or any new or useful improvement [thereof]." Act of Feb. 21, 1793, ch. 11, § 1, 1 Stat. 318. The Act embodied Jefferson's philosophy that "ingenuity should receive a liberal encouragement." V Writings of Thomas Jefferson, at 75-76. See *Graham* v. *John Deere Co.,* 383 U.S. 1, 7-10 (148 USPQ 459, 462-464) (1966). Subsequent patent statutes in 1836, 1870, and 1874 employed this same broad language. In 1952, when the patent laws were recodified, Congress replaced the word "art" with "process," but otherwise left Jefferson's language intact. The Committee Reports accompanying the 1952 Act inform us that Congress intended statutory subject matter to "include anything under the sun that is made by man." S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952); H.R. Rep. No. 1923, 82d Cong., 2d Sess., 6 (1952).
> This perspective has been embraced by the Federal Circuit:

> The plain and unambiguous meaning of section 101 is that ***any new and useful*** process, ***machine***, manufacture, or composition of matter, or any new and useful improvement thereof, ***may be patented*** if it meets the requirements for patentability set forth in Title 35, such as those found in sections 102, 103, and 112. The use of the expansive term "any" in section 101 represents Congress's intent not to place any restrictions on the subject matter for which a patent may be obtained beyond those specifically recited in section 101 and the other parts of Title 35... Thus, **it is improper to read into section 101 limitations as to the subject matter that may be patented where the legislative history does not indicate that Congress clearly intended such limitations.** *Alappat*, 33 F.3d at 1542, 31 USPQ2d at 1556.

Applicant asserts that the claimed invention clearly falls within the enumerated statutory category of a machine. Further, Applicant notes that the practical application of the claimed invention to the technical arts is presented, for example, in the Background of the Invention, and elsewhere throughout the specification. In particular, an apparatus that determines whether a sequence of random binary bits is predictable, as recited in claim 15, has practical application in the technological arts, including for example in "a cryptography system, an audio or video noise generator, a computer program, or other devices and processes." (Applicant's specification paragraph [0015])

Further, Applicant points out that the invention can be carried out using "circuits such as a digital signal processor circuit or an application-specific-integrated circuit (ASIC)." (Applicant's specification paragraph [0025]) Clearly an apparatus such as a digital signal processor circuit or an ASIC that includes a "random number generator unit," a "detector unit," and a "switching unit," as recited in claim 15, falls within the enumerated category of a machine as recited in 35 U.S.C. § 101.

Claim 19

Claim 19 recites in part "A machine-readable medium having stored thereon data representing sequences of instructions, and the sequences of instructions which, when executed by a processor, cause the processor to...". As the Office action correctly points out at page 4, item 5:

> "a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the

> computer which permit the computer program's functionality to be realized, **<u>and is thus statutory</u>**." (emphasis added)

Because claim 19 recites subject matter that the Office action specifically identifies as patentable subject matter, Applicant asserts that claim 19 recites patentable subject matter. If the Examiner maintains that claim 19 does not recite patentable subject matter, Applicant respectfully requests that the Examiner explain how the above-identified rule does not apply to claim 19.

Claim 19 has been amended to include instructions that cause the processor to "determine whether the generated random numbers are predictable in response to the comparison of the output of the exponential averaging operations to a predetermined acceptance range." Determining whether random numbers are predictable has practical application in the technological arts, <u>including for example in "a cryptography system, an audio or video noise generator, a computer program, or other devices and processes</u>." (Applicant's specification paragraph [0015])

<u>Claim Rejections Under 35 U.S.C. 112</u>

Claims 1 and 9 are rejected because the terms "properly providing" and "not properly providing" are relative terms which render the claims indefinite. Applicant has amended claim 1 to recite:

> "determining whether the random number generator is providing random numbers that are ***sufficiently random*** by comparing an output of the exponential averaging operation to a predetermined acceptance range"

and claim 9 to recite:

> "(d) determining that the random number generator is not generating random numbers that are ***sufficiently random*** when the output of the computed exponential averaging operation falls outside the predetermined acceptance range."

Support for the amendments is found, for example, at paragraphs [0005], [0015], and [0016]. As recited in claims 1 and 9, the sufficiency of the randomness is determined by comparing the exponential average to an acceptance range. The

specific thresholds that make up the acceptance range depend on the application. Although the specific thresholds that make up the acceptance range depend on the application, the same process for determining the sufficiency of the randomness is applied regardless of the application. That is, exponential averaging is used to determine an average and the average is compared to an acceptance range. Examples of what makes a random number sufficiently random are found at paragraphs [0017] and [0023] of Applicant's specification. At paragraph [0017] a random number is sufficiently random if "given one or more random numbers, any other bit of the random sequence would be impossible to predict with more than 50% probability." At paragraph [0023] a random number is sufficiently random if "the number of 0 and 1 bits is roughly the same" where "'roughly' means that, taking n samples, the sum of the bits is within the range of $[n/2 - c \cdot \sqrt{n}, n/2 + c \cdot \sqrt{n}]$."

In view of the above-described amendments, Applicant asserts that claims 1 and 9 particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6, 13, 17, and 21 were rejected under the logic "the limitation 'exponential averaging operation' is indefinite because its definition cited in the claim is not exponential average operation but rather the claim expression becomes linear function count because n is defined as a very large number and the relationship of n parameter is not defined." Applicant has amended claims 6, 13, 17, and 21 to recite "wherein n represents a number of bits." Support for the amendment is found, for example, at paragraph [0021].

Because the averaging operation is repeatedly updated by recalculating a new average (A_{new}) using a function of the previously calculated average (i.e., $\alpha \cdot A_{old}$), the averaging operation is characterized as an exponential function. Applicant points out that exponential averaging, also known as "exponential moving average" (EMA) and "exponentially weighted moving average" (EWMA), is a well-known moving average concept. Applicant points to Appendix A, which provides an explanation of exponential moving averaging. The document provided in Appendix A comes from a

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well-known on-line encyclopedia service (www.wikipedia.com) and provides various credible references as support. Applicant notes that a similar explanation of exponential averaging is provided in Applicant's specification at paragraph [0021]. For example, Appendix A identifies a "smoothing factor α, a number between 0 and 1" while Applicant discloses a "factor, α, which falls between 0 and 1." Further, Appendix A identifies the expression "$EMA_{today} = EMA_{yesterday} + \alpha \times (price - EMA_{yesterday})$," while Applicant's specification discloses "$A_{new} = \alpha \cdot A_{old} + b$." Given that the concept of exponential averaging is well-known, as evidenced by Appendix A, and given the close correspondence between the disclosed exponential averaging operation and the known concept, Applicant asserts that use of the term "exponential averaging" in claims 6, 13, 17, and 21 provides a very definite meaning.

Double Patenting Rejection

Once the Examiner has deemed the claims allowable, Applicant will timely file the necessary Terminal Disclaimer with respect to U.S. Patent No. 6,947,960.

New Claims

Claim 23

Claim 23 is dependent on claim 1 and recites "determining whether to utilize a random number from the stream of random numbers in ***an encryption application*** in response to the determination of whether the random number generator is providing random numbers that are sufficiently random." Support for this amendment is found in Applicant's specification, for example, at paragraph [0002]. Applicant asserts that utilizing a random number in ***an encryption application*** is a useful, concrete, and tangible result, which is clearly patentable subject matter under 35 U.S.C. § 101.

Claim 24

Claim 24 is dependent on claim 9 and includes a similar limitation to claim 23. Although the language of claim 24 differs from the language of claim 23 and the

PAGE 14/21 * RCVD AT 6/19/2007 6:45:52 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-2/18 * DNIS:2738300 * CSID:9252490111 * DURATION (mm-ss):06-32

scope of claim 24 should be interpreted independently of claim 23, Applicant respectfully asserts that the remarks provided above in regard to claim 23 also apply to claim 24.

CONCLUSION

In view of the foregoing explanations, Applicant respectfully requests that the Examiner reconsider and reexamine the present application, allow claims 1 – 3, 5 – 10, and 12 – 24 and pass the application to issue. In the event that there are any outstanding matters remaining in the present application, the Examiner is invited to contact Mark A. Wilson (Reg. No. 43,994) at (925) 249-1300 to discuss these matters.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment (except for the issue fee) to Deposit Account No. 50-3444 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17, particularly extension of time fees.

Respectfully submitted,

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APPENDIX A

Moving average

From Wikipedia, the free encyclopedia

In statistics, a **moving average** is one of a family of similar techniques used to analyze time series data. It is applied in finance and especially in technical analysis. It can also be used as a generic smoothing operation, in which case the raw data need not be a timeseries.

A moving average series can be calculated for any time series. In finance it is most often applied to stock prices, returns or trading volumes. Moving averages are used to smooth out short-term fluctuations, thus highlighting longer-term trends or cycles. The threshold between short-term and long-term depends on the application, and the parameters of the moving average will be set accordingly.

Mathematically, each of these moving averages is an example of a convolution. These averages are also similar to the low-pass filters used in signal processing.

Contents

Simple moving average

Prior moving average

A **simple moving average** (SMA) is the unweighted mean of the previous *n* data points. For example, a 10-day simple moving average of closing price is the mean of the previous 10 days' closing prices. If those prices are $p_M, p_{M-1} \cdots p_{M-9}$ then the formula is

$$SMA = \frac{p_M + p_{M-1} + \cdots + p_{M-9}}{10}$$

When calculating successive values, a new value comes into the sum and an old value drops out, meaning a full summation each time is unnecessary,

$$SMA_{\text{today}} = SMA_{\text{yesterday}} - \frac{p_{M-n+1}}{n} + \frac{p_{M+1}}{n}$$

In technical analysis there are various popular values for *n*, like 10 days, 40 days, or 200 days. The period selected depends on the kind of movement one is concentrating on, such as short, intermediate, or long term. In any case moving average levels are interpreted as support in a rising market, or resistance in a falling market.

In all cases a moving average lags behind the latest data point, simply from the nature of its smoothing. An SMA can lag to an undesirable extent, and can be disproportionately influenced by old data points dropping out of the average. This is addressed by giving extra weight to more recent data points, as in the WMA and EMA below.

One characteristic of the SMA is that if the data has a periodic fluctuation, then applying an SMA of that period will eliminate that variation (the average always containing one complete cycle). But a perfectly regular cycle is rarely encountered in economics or finance.[1]

Central moving average

For a number of applications it is advantageous to avoid the shifting induced by using only 'past' data. Hence a **central** moving average can be computed, using both 'past' and 'future' data. The 'future' data in this case are *not* predictions, but merely data obtained after the time at which the average is to be computed.

Weighted and exponential moving averages (see below) can also be computed centrally.

Weighted moving average

A weighted average is any average that has multiplying factors to give different weights to different data points. But in technical analysis a **weighted moving average** (WMA) has the specific meaning of weights which decrease arithmetically. In an n-day WMA the latest day has weight n, the second latest $n-1$, etc, down to zero.

$$WMA_M = \frac{np_M + (n-1)p_{M-1} + \cdots + 2p_{M-n+2} + p_{M-n+1}}{n + (n-1) + \cdots + 2 + 1}$$

When calculating the WMA across successive values, it can be noted the difference between the numerators of WMA_{M+1} and WMA_M is $np_{M+1} - p_M - \cdots - p_{M-n+1}$. If we denote the sum $p_M + \cdots + p_{M-n+1}$ by $Total_M$, then

$$Total_{M+1} = Total_M + p_{M+1} - p_{M-n+1}$$

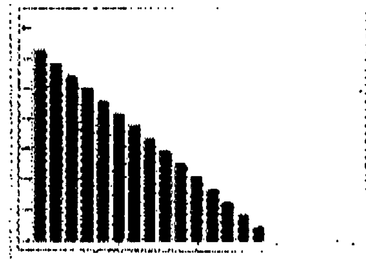
$$Numerator_{M+1} = Numerator_M + np_{M+1} - Total_M$$

$$WMA_{M+1} = \frac{Numerator_{M+1}}{n + (n-1) + \cdots + 2 + 1}$$

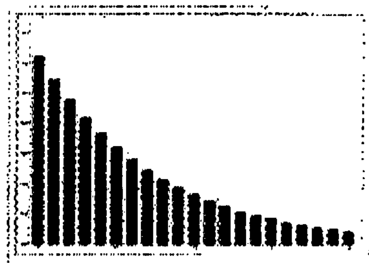
The denominator is a triangle number, and can be easily computed as $\frac{n(n+1)}{2}$

The graph at the right shows how the weights decrease, from highest weight for the most recent data points, down to zero. It can be compared to the weights in the exponential moving average which follows.

Exponential moving average



WMA weights n=15



EMA weights N=15

An **exponential moving average** (EMA), sometimes also called an **exponentially weighted moving average** (EWMA), applies weighting factors which decrease exponentially. The weighting for each older data point decreases exponentially, giving much more importance to recent observations while still not discarding older observations entirely. The graph at right shows an example of the weight decrease.

The degree of weighing decrease is expressed as a constant *smoothing factor* α, a number between 0 and 1. α may be expressed as a percentage, so a smoothing factor of 10% is equivalent to α=0.1. Alternatively, α may be expressed in terms of N time periods, where $\alpha = \frac{2}{N+1}$. For example, N=19 is equivalent to α=0.1.

The observation at a time period t is designated Y_t, and the value of the EMA at any time period t is designated S_t. S_1 is undefined. S_2 may be initialized in a number of different ways, most commonly by setting S_2 to Y_1, though other techniques exist, such as setting S_2 to an average of the first 4 or 5 observations. The prominence of the S_2 initialization's effect on the resultant moving average depends on α; smaller α values make the choice of S_2 relatively more important than larger α values, since a higher α discounts older observations faster.

The formula for calculating the EMA at time periods t≥2 is

$$S_t = \alpha \times Y_{t-1} + (1-\alpha) \times S_{t-1}$$

This formulation is according to Hunter (1986)[2]; an alternate approach by Roberts (1959) uses Y_t in place of Y_{t-1}[3]

This formula can also be expressed in technical analysis terms as follows, showing how the EMA steps towards the latest data point, but only by a proportion of the difference (each time):[4]

$$EMA_{\text{today}} = EMA_{\text{yesterday}} + \alpha \times (price - EMA_{\text{yesterday}})$$

Expanding out $EMA_{yesterday}$ each time results in the following power series, showing how the weighting factor on each data point p_1, p_2, etc, decrease exponentially:

$$EMA = \frac{p_1 + (1-\alpha)p_2 + (1-\alpha)^2 p_3 + (1-\alpha)^3 p_4 + \cdots}{1 + (1-\alpha) + (1-\alpha)^2 + (1-\alpha)^3 + \cdots}$$

In theory this is an infinite sum, but because $1-\alpha$ is less than 1, the terms become smaller and smaller, and can be ignored once small enough. The denominator approaches $1/\alpha$, and that value can be used instead of adding up the powers, provided one is using enough terms that the omitted portion is negligible.

The N periods in an N-day EMA only specify the α factor. N is not a stopping point for the calculation in the way it is in an SMA or WMA. The first N data points in an EMA represent about 86% of the total weight in the calculation.

The power formula above gives a starting value for a particular day, after which the successive days formula shown first can be applied.

The question of how far back to go for an initial value depends, in the worst case, on the data. If there are huge p price values in old data then they'll have an effect on the total even if their weighting is very small. If one assumes prices don't vary too wildly then just the weighting can be considered. The weight omitted by stopping after k terms is

$$(1-\alpha)^k + (1-\alpha)^{k+1} + \cdots,$$

which is

$$(1-\alpha)^k \times (1 + (1-\alpha) + (1-\alpha)^2 \cdots),$$

i.e. a fraction

$$\frac{(1-\alpha)^k}{\alpha}$$

out of the total weight.

For example, to have 99.9% of the weight,

$$k = \frac{\log(0.001 \times \alpha)}{\log(1-\alpha)}$$

terms should be used. Since $\log(1-\alpha)$ approaches $\frac{-2}{N+1}$ as N increases, this simplifies to approximately

$$k = 3.45 \times (N+1)$$

for this example (99.9% weight).

Other weightings

Other weighting systems are used occasionally – for example, in share trading a **volume weighting** will weight each time period in proportion to its trading volume.

A further weighting, used by actuaries, is Spencer's 15-Point Moving Average[5] (a central moving average).

See also

- Moving average convergence/divergence
- Exponential smoothing

Notes and references

1. ^ *Statistical Analysis*, Ya-lun Chou, Holt International, 1975, ISBN 0030894220 , section 17.9.
2. ^ NIST/SEMATECH e-Handbook of Statistical Methods: Single Exponential Smoothing (http://www.itl.nist.gov/div898/handbook/pmc/section4/pmc431.htm) at the National Institute of Standards and Technology
3. ^ NIST/SEMATECH e-Handbook of Statistical Methods: EWMA Control Charts (http://www.itl.nist.gov/div898/handbook/pmc/section3/pmc324.htm) at the National Institute of Standards and Technology
4. ^ Moving Averages page (http://www.stockcharts.com/education/IndicatorAnalysis/indic_movingAvg.html) at StockCharts.com
5. ^ http://mathworld.wolfram.com/Spencers15-PointMovingAverage.html

External links

- Discussion of span and shift for prior MA (http://www.asu.edu/it/fyi/unix/helpdocs/statistics/sas/sasdoc/sashtml/qc/chap21/sect12.htm)
- Discussion of prior MA and central MA (http://www.apheo.ca/indicators/pages/resources/calculating_moving_averages.html)

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